Empirical Probes of a Memory-Based Scalar Field $\mu(x,t)$

A Proposed Experimental Research Program for Inward Physics

Daniel Jacob Read IV

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Abstract

Inward Physics proposes that physical reality is organized around a scalar field $\mu(x,t)$, interpreted as a density of preserved internal structure ("memory"), from which mass, gravity, time-rate, and consciousness emerge as secondary phenomena. This document does not claim experimental confirmation of $\mu(x,t)$. As of December 2025, no independent empirical validations exist outside the originating corpus. Instead, this work defines a falsifiable experimental research program: a structured set of proposed probes, proxy measurements, null expectations, and scaling constraints intended to bound or detect possible couplings between $\mu(x,t)$ and observable systems.

The objective is not immediate verification, but disciplined constraint. All experiments proposed herein are explicitly speculative, designed to be reproducible, statistically testable, and compatible with recovery of known classical limits. Failure of these experiments constrains allowable coupling strengths rather than falsifying the conceptual framework outright.

1 Conceptual Background and Testability

1.1 Role of the Memory Field

The scalar field $\mu(x,t)$ is postulated as a Lorentz-invariant quantity representing preserved internal structure across spacetime. Unlike energy or information as traditionally defined, μ is not operationally observable and must be inferred indirectly through hypothesized effects on inertia, spacetime curvature, time-rate, and coherence phenomena.

1.2 Criteria for Empirical Engagement

For an experiment to meaningfully test the framework, it must satisfy three conditions:

(a) Isolation from known electromagnetic, thermal, mechanical, and biochemical confounds.

(b) Explicit falsifiability via a defined null outcome and pre-registered analysis plan.

(c) Scalability or bounding of possible coupling strengths.

Experiments failing these criteria are classified as exploratory.

2 Experiment A: Gravitational Response to Memory Modulation

2.1 Motivation

Inward Physics posits that mass and gravitation arise from spatial gradients in $\mu(x, t)$, suggesting a weak-field relation:

$$\mathbf{g} \propto -\nabla\mu.$$

2.2 Experimental Setup

A high-precision gravimeter or atom interferometer is positioned adjacent to a high-density nonvolatile memory reservoir (e.g., MRAM), enclosed within electromagnetic, magnetic, thermal, and vibrational shielding. Environmental variables are continuously monitored.

2.3 Method

Memory states are alternated between low-structure and high-structure configurations using randomized bit patterns and timing. Operators and analysts are blinded to experimental timing.

2.4 Predictions and Null Expectation

A statistically significant correlation between memory modulation and local gravitational acceleration would support the hypothesis. Absence of correlation constrains coupling

strength.

2.5 Practical Assessment

Any such effect is expected to lie far below current detectability. Null results therefore function as upper bounds rather than decisive falsification.

3 Experiment B: Time-Rate Drift Near Dense Memory Structures

3.1 Motivation

The theory predicts that proper time-rate scales inversely with μ:

$$\frac{d\tau}{dt} \propto \frac{1}{\mu}.$$

3.2 Experimental Setup

Two synchronized atomic clocks are employed, one placed near the memory reservoir and one serving as a control, both isolated from environmental interference.

3.3 Method

Memory modulation cycles are applied intermittently over extended durations. Phase drift is analyzed using Bayesian inference.

3.4 Interpretation

Observed drift correlated with memory modulation would indicate a time-rate coupling. Null results constrain deviations while preserving consistency with general relativity.

4 Biofeedback Coherence as a Proxy for Field Stability

4.1 Motivation

Biological systems may act as sensitive amplifiers of coherence fluctuations associated with $\mu(x, t)$.

4.2 Proxy Metrics

Observable proxies include heart rate variability, EEG spectral coherence, and inter-subject synchrony. Reduced variance is interpreted as reduced μ-gradients.

4.3 Experimental Design

Participants undergo baseline, intervention, and recovery phases while physiological signals are recorded. Control groups and blinded analysis are required.

4.4 Scientific Status

These experiments are reproducible but interpretively ambiguous, as results may reflect known psychophysiological mechanisms.

5 Distributed Biological Networks and Mycorrhizal Systems

5.1 Motivation

Fungal mycelial networks exhibit persistent electrical signaling and distributed structure, suggesting a potential analog for macroscopic memory-field behavior.

5.2 Framework

Instrumented mycelial cultures are monitored while participants engage in structured coherence tasks. These studies are exploratory.

6 Additional Protocols and Personal-Scale Experiments

Everyday cognitive and relational dynamics may be treated as informal laboratories for coherence modulation. These protocols are hypothesis-generating rather than confirmatory.

7 Interpretation and Limits

This program occupies an intersection of speculative physics, systems biology, and cognitive science. Its primary contribution is disciplined falsifiability and parameter constraint.

Conclusion

The experiments outlined here do not establish the existence of a memory-based scalar field. They establish a rigorous methodology for constraining or rejecting such a hypothesis.

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Program Map: $\mu(x,t)$ Probes and Observables

$\mu(x,t)$ — **Memory-Based Scalar Field (Unobserved)**
Experiment A: Gravitational Probe
Gravimeter / Atom Interferometer
Test: $\mathbf{g} \propto -\nabla\mu$
Observable: Δg
Experiment B: Temporal Probe
Atomic Clock Pair
Test: $d\tau/dt \propto 1/\mu$
Observable: Phase drift
Coherence Probes
EEG / HRV / Inter-subject synchrony
Proxy: Stability and alignment
Observable: Coherence metrics
Distributed Substrates
Mycelial electrophysiology
Goal: Correlation studies
Observable: Signal patterns
Method Discipline
Pre-registration, blinding, controls
Null results constrain coupling strength

Interpretation rule: Positive effects require multi-site replication. Null results constrain scale and coupling assumptions.